

Space Weather Technical Forecast

Issued on Sunday, 05 December 2021 at 00:28 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Slight chance of G1/Minor Storm activity next 24 hours. Active fluence likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was low, with several C class flares, the strongest being a long period C7 flare from AR2898, peaking at 04/2359 UTC. There are currently two sunspot regions on the visible disc. AR2898 was responsible for most of the C flares but this region has now rotated around the southwest limb. AR2902 in the northwest, which has faded significantly is now a Hrx/alpha, and the new region in the southeast numbered 2904 is classified Axx/Alpha. No Earth-directed CMEs have been observed in coronagraph imagery. The CME associated with the C4 flare has been analysed and is not Earth directed.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, was slightly elevated to start the period at around 480 km/s. It then increased to elevated levels reaching a maximum of 534km/s at 04/0257 UTC, before dropping back and is currently around 460 km/s. Density has been mainly average levels. The IMF Bt was generally weak, at or below 8nT. The north-south component Bz, has ranged between +/-6 nT, but has mostly been between -3/+3 nT. The Phi angle was predominantly in a positive orientation (away from the Sun). Resultant geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) remained at background levels. The high energy electron flux (greater than 2 MeV) was High (greater than 1000 pfu) between 04/1700 UTC and 04/1945 UTC, reaching a maximum of 1200 pfu at 04/1850 UTC. Returning to background to Moderate levels since. The associated 24-hour integrated fluence was above the Active threshold (1e8 integrated pfu) until 04/0600 UTC. Observed fluence at 05/0001 UTC was 4.21e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be low reducing to very low, with a 50% chance of C-flares and a 5% chance of M-flares at first from AR2898 which is no longer visible on the southwest limb. The flare risk will reduce as this region rotates further around the limb.

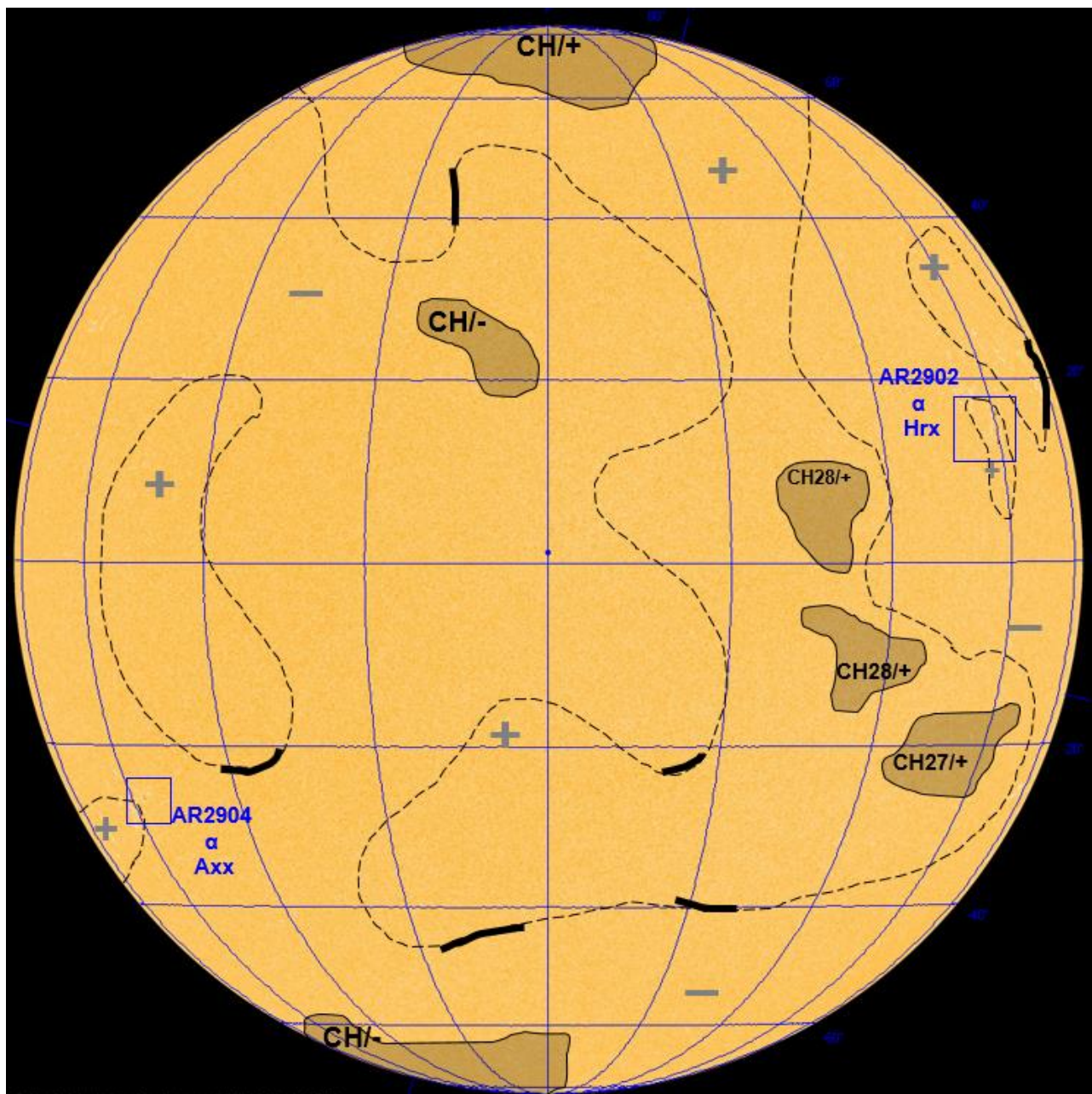
Solar Wind / Geomagnetic Activity: There are currently no Earth-directed CMEs expected. A very weak CME from a filament eruption on 03 Nov may graze Earth on Day 4 (07 Nov), but this is low confidence and minimal impacts are expected.

Wind speeds are currently slightly elevated, likely due to either CH27/+ or CH28/+. Speeds are expected to gradually decline to background levels through days 1 or 2 (5th or 6th Dec).

Geomagnetic activity is currently mainly Quiet to Unsettled with a slight chance of isolated G1/Minor Storm intervals, most likely early on day 1 (5th). Quiet to Unsettled activity is expected thereafter, with a chance of the odd Active interval if any weak CME influence occurs.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is likely to return to predominantly High levels. The associated 24 hour integrated fluence is currently just below the Active threshold ($1e8$ integrated pfu) due to the recent sharp drop in flux levels. Fluence is most likely to become Active again and remain so through this period, although confidence is a little low.

Figure 1. Solar Analysis Valid 04/2000 UTC.



Key: Filament — , Prominence — , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

There are currently no Earth-directed CMEs. A very weak CME from a filament eruption on 03 Nov may graze Earth on Day 4 (07 Nov), but this is low confidence and minimal impacts are expected.

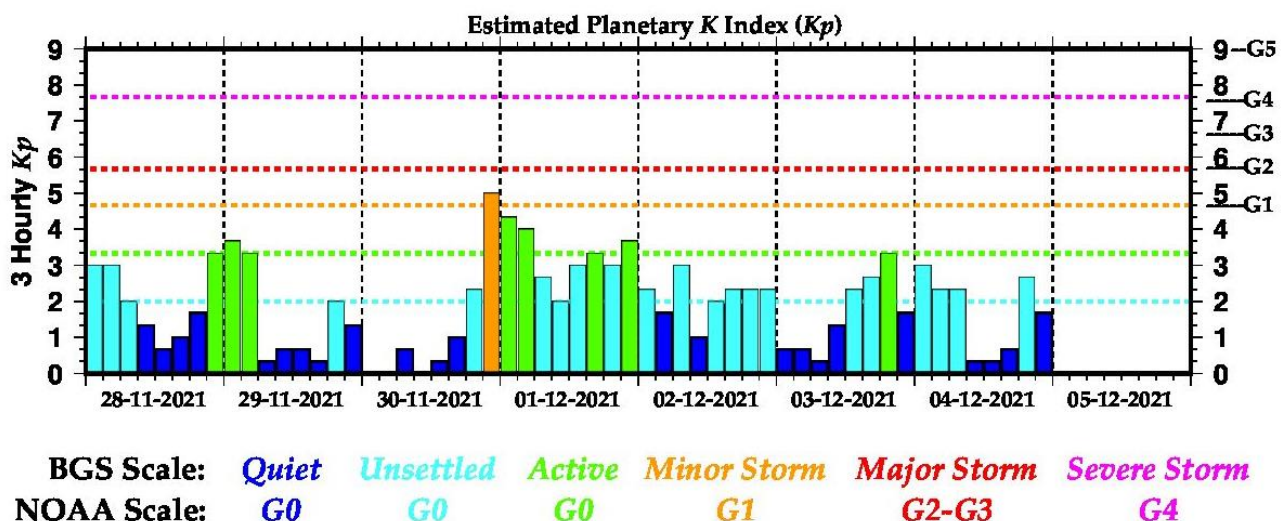
Wind speeds are currently slightly elevated, likely due to the high speed stream from either CH27/+ or CH28/+. These coronal holes were only present as a weak feature on the last rotation which didn't really connect. They have become more fragmented into three separate holes in the last 24 hours, so wind speeds are unlikely to go much higher than they already have. As such, wind speeds are expected to gradually decline to background levels through day 1 (5th).

Geomagnetic activity is currently mainly Unsettled with a slight chance of isolated G1/ Minor Storm intervals during day 1 (5th) due to the influence of CH27 and CH28. Quiet to Unsettled activity is expected thereafter, with a chance of the odd Active interval if any weak CME influence occurs.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	5	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections - Nil

Figure 2: BGS Kp mainly Quiet to Unsettled on the 4th Dec.



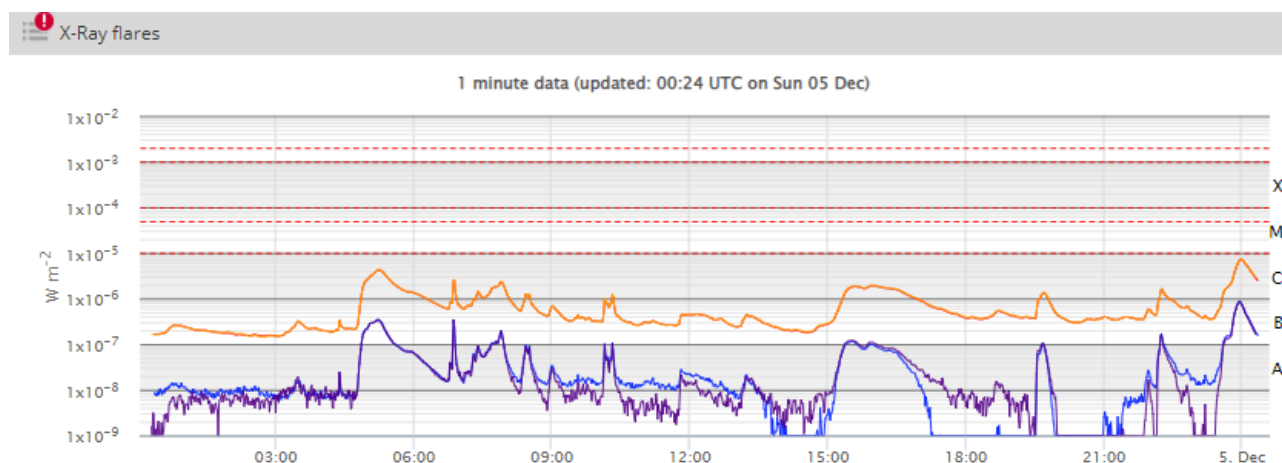
Radio Blackouts - X-Ray Flares:

Solar Activity is currently Low, with a C7 flare peaking at 04/2359 UTC from AR2898 beyond the southwest limb. This region is now off the disc, but showed some signs of development before it became less visible as it reached the limb. It is not possible to assess the current configuration or magnetic complexity as it can't be seen properly, but further flares are likely from this region until it is well over the limb. There are currently two other small sunspot regions on the visible disc, all of which are small and simple and unlikely to give significant flaring in their current configurations.

As such, the probability of C-class flares is assessed as 50% with a 5% risk of M-class flares from AR2898. This risk is reducing as the region rotates further off the disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	2	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES16 X-ray flares peaking at C7 at 04/2359UTC.



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is forecast to remain at background levels, with no solar radiation storms anticipated.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 [*]	No	1	1	1	1

^{*} S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) as observed by GOES-16 showed a sharp drop from the peak on Friday during the UTC evening. This may have been a result of some radiation belt compression with the arrival of the fast wind of CH27/CH28. Wind speeds are already dropping, and it is likely that we will see a recovery in flux values back to High levels during day 1, perhaps with a slight increase as further charging may have occurred.

The associated 24 hour electron fluence is currently just below the Active (greater than 1e8 integrated pfu) threshold due to the recent drop out in flux levels. Confidence for Active fluence is a little low given the recent sharp drop in flux values, but the most likely scenario is a return to Active fluence during days 1 and 2 (5th and 6th), then probably remaining above through Days 3 and 4 (7th and 8th Dec). REFM is suggesting a downward trend but is considered to be reducing values too quickly.

GEO Electron Environment	Level (cm ⁻² sr ⁻¹ day ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1x10 ⁸	Yes	80	70	60	50
Very Active	≥ 2 MeV ≥ 1x10 ⁹	No	1	5	5	1